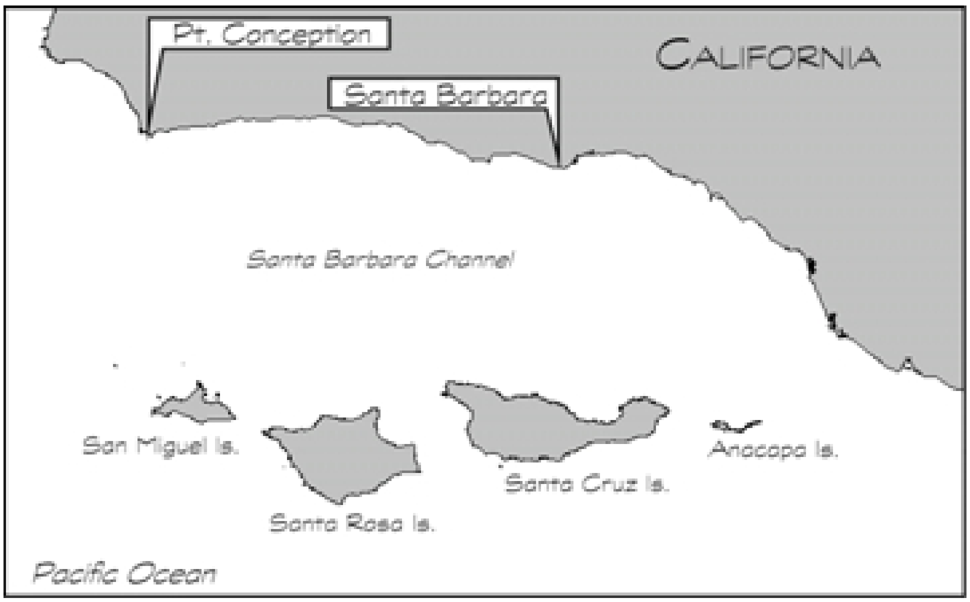
User's Guide

Welcome to the Location File for Santa Barbara Channel, located along the southern California coast of the U.S.



NOAA created Location Files for different U.S. coastal regions to help you use the General NOAA Oil Modeling Environment, GNOME. In addition, on a case-by-case basis, NOAA develops international Location Files when working with specific partners. Each Location File contains information about local oceanographic conditions that GNOME uses to model oil spills in the area covered by that Location File. Each Location File also contains references (both print publications and Internet sites) to help you learn more about the location you are simulating.

As you work with GNOME's Location File for Santa Barbara Channel, you'll be prompted to:

1. Select one of the six possible circulation patterns typical of this area.
2. Choose the model settings (start date and time, and run duration).
3. Input the wind conditions.

Santa Barbara Channel is a coastal area where the circulation is constantly changing. The local winds are highly variable, and the channel is located within the Southern California Bight, where cold, upwelled water meets warmer water from farther south. The currents that flow along the southern islands and northern continental coast can flow in the same direction or act independently. Oceanographers have defined six distinct current patterns that can occur within the Channel (Harms 1996). To model spills in the Channel, you'll need to pick one of these six current patterns. For help in making this choice, try out GNOME's current pattern **decision aid**, which is included below. (To learn more about these current patterns, check the Help topic "Selecting a Current Pattern.")

Your choice of current pattern depends on the purpose for which you're using GNOME. To learn how currents may affect oil spill trajectories within the Channel, run GNOME using different current patterns. To create a specific scenario, choose the current pattern that will move the oil closest to your desired endpoint. To simulate today's conditions, access today's current and weather observations from http://www-ccs.ucsd.edu/oilspill, then use the decision aid or your own expertise to choose the pattern that best fits the real-life conditions.

To set up a spill scenario, you'll also choose model settings and enter wind conditions. Click Help anytime you need help setting up the model. Click Finding Wind Data to see a list of web sites that publish wind data for this region.

You can find more information about GNOME and Location Files at http://response.restoration.noaa.gov/software/gnome/gnome.html .

Use the decision aid outlined below to narrow down your current pattern choices. If you are using current observations, you may not be able to select a single current pattern. In that case, either run the trajectory with each possible current pattern or choose the current pattern that most closely matches the circulation in the vicinity of your oil spill. The most important areas to observe are the eastern and western entrances, and the northern and southern boundaries.

Is all the water in the channel moving in the same direction? (Ignore currents outside the channel.)

If YES, which direction?
If eastward, then your best choice is FLOOD EAST.
If westward, then your best choice is FLOOD WEST.

If NO, which direction is the water flowing at the eastern entrance?

If OUT OF the channel, then your best choice may be UPWELLING. [During upwelling, expect to see: (1) in the southern part of the channel, relatively strong currents moving toward the eastern entrance, and (2) in the northern part of the channel, relatively weaker currents moving toward the western entrance.]

If INTO the channel, then check the relative directions and magnitudes of the currents at the western entrance, as follows:

(A) If the currents are more out of the channel in the northern part of the entrance and the currents are more into the channel in the southern part of the entrance, then:

If the currents are stronger in the northern portion of the channel than in the southern portion, your best choice may be RELAXATION.

If the currents have similar speeds, then:

(i) If the currents are faster than 10 cm/sec, your best choice may be CYCLONIC.

(ii) If the currents are less than 10 cm/sec, your best choice may be MILLING.

If you can't decide between RELAXATION, CYCLONIC and MILLING, you may need to run the spill using each current pattern.

(B) If your data does not fit any of the above current patterns, you may be in a transitional period, or smaller-scale phenomena (e.g., eddies) may be masking the larger-scale circulation that might otherwise be evident in current meter reading. You may want to look at the data for the previous few days to improve your sense of what is happening in the channel.

Technical Documentation

Background

The Santa Barbara Channel region is oceanographically complex because of the variety of atmospheric and oceanic conditions that may be present in the area at one time, some with distinctly different regimes separated by up to 10 kilometers. Cold, upwelled water meets warm, subtropic Southern California Bight water in Santa Barbara Channel (Chelton 1984; Lynn and Simpson 1987). The large-scale surface flow is southward (alongshore) in spring and northward (alongshore) between summer and winter, but these large-scale flows can reverse for periods up to a week (Harms 1996). The mean flow of Santa Barbara Channel is a cyclonic (counterclockwise) eddy located at the western end of the channel.

The circulation in the Santa Barbara Channel is driven by (Harms 1996):

- Wind Stress.
- Wind Stress curl (Ekman pumping).
- Alongshelf pressure gradients.

The Santa Barbara Channel Location File simulates mean conditions in the six circulation modes defined by Harms (1996). To include the transitional periods and different intensities in the main circulation modes you must work in GNOME's Diagnostic Mode. (For training in the use of GNOME’s GIS Output or Diagnostic Mode, contact NOAA HAZMAT at GNOMEWizard@hazmat.noaa.gov or at (206) 526-6317.) Using the Location File, you may not be able to simulate real conditions on a particular day; however, the Location File is sufficient for building intuition and creating scenarios.

Current Patterns

The user's six circulation choices were created using combinations of three current patterns: two barotropic patterns representing flow along the mainland and island shelves, and a current pattern representing flow due to typical density (temperature) gradients in the Santa Barbara Channel. All current patterns were created by the NOAA Current Analysis for Trajectory Simulation (CATS) hydrodynamic application.

The current pattern representing the density gradients is the minimum barotropic mode (Galt, 1980, and Galt, et al. 1978) derived from a data assimilation model courtesy of Dr. Dong-Ping Wang (State University of New York), Dept. of the Interior Mineral Management Service, and the University of California (San Diego) Center for Coastal Studies. The model is a three-dimensional primitive-equation, coastal ocean general circulation model with a constant *z* coordinate that uses three-dimensional "blending" for data assimilation (Chen & Wang, submitted). An average of the model spring density fields (days 86 to 156 of year 1994) was used to create the local dynamic height fields. A level of no motion of 250 meters (m) was assumed since the model is homogeneous below 250 m. The NOAA CATS hydrodynamic application was used to calculate the corresponding current pattern.

References

You can get more information about Santa Barbara Channel from these publications and web sites.

Oceanographic

Chelton, D. B. (1984). Seasonal variability of alongshore geostrophic velocity off central California. Journal of Geophysical Research. 89(C3): 3473-3486.

Chen, C.-S. and D.-P. Wang. Data Assimilation Model Study of the Santa Barbara Channel Circulation. Submitted to Journal of Geophysical Research.

Dever, E. P. (1998), M. C. Hendershott, and C. D. Winant (1998). Statistical aspects of surface drifter observations of circulation in the Santa Barbara Channel. Journal of Geophysical Research. 103(C11): 24,781-24,797.

Galt, J. A. (1980). A Finite-Element Solution Procedure for the Interpolation of Current Data in Complex Regions. Journal of Physical Oceanography. 10: 1984-1997.

Galt, J. A., J. E. Overland, C. H. Pease and R. J. Stewart. Numerical Studies--Pacific Marine Environmental Laboratory Report to OCSEAP. September, 1978, 177 pp.

Gunn, J.T., et al (1987). Santa Barbara Channel Circulation Model and Field Study. OCS Study MMS 87-0089, 393 pp.

Harms, Sabine (1996). "Circulation Induced by Winds and Pressure Gradients in the Santa Barbara Channel." Doctoral dissertation, University of California, San Diego, 161 pp.

Hickey, B. M. (1979). The California Current System—hypotheses and facts. Progress in Oceanography, Vol. 8, pp. 191-279.

Lynn, R. J. and J. J. Simpson (1987). The California Current System: The seasonal variability of its physical characteristics. Journal of Geophysical Research. 92(C3): 12947-12966.

Wind and Weather

Scripps Institution of Oceanography (SIO)
http://meteora.ucsd.edu/weather.html
An informative weather-related web site. Offers local and regional weather reports, forecasts, and related links.

Scripps Institution of Oceanography California Coastal Weather
http://meteora.ucsd.edu/weather_coastal.html
Local and regional weather reports, forecasts, and other weather sources.

Center for Coastal Studies
http://www-ccs.ucsd.edu/oilspill
Provides recent and archived wind and current data for the California Bight, including Santa Barbara Channel.

NOAA National Weather Service (NWS)
http://www.nws.noaa.gov
Current weather observations, forecasts, and warnings for the entire U.S.

Oil Spill Response

NOAA Hazardous Materials Response Division (HAZMAT)
http://response.restoration.noaa.gov
Tools and information for emergency responders and planners, and others concerned about the effects of oil and hazardous chemicals in our waters and along our coasts.